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ABSTRACT

This book features 34 reproducible student activities exploring textile design through a combination of mathematics, art, and multicultural education. Using colorful squares and triangles, students explore geometry, numbers, area, fractions, logic, and discrete mathematics, while incorporating multicultural themes in the study. The teacher page for each student activity includes facts about a culture, a mathematics problem challenge, a description of the activity, possible solutions, and questions for class reflection and discussion. Seven cultures from around the world are represented, including: (1) Colonial America; (2) Amish; (3) Navajo; (4) African; (5) Hmong (Thailand); (6) Mayan (Guatemala); and (7) Maori (New Zealand). Contains a total of 40 references. (EH)

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GRADES 3-6

TexTile Math™

Multicultural Explorations Through Patterns

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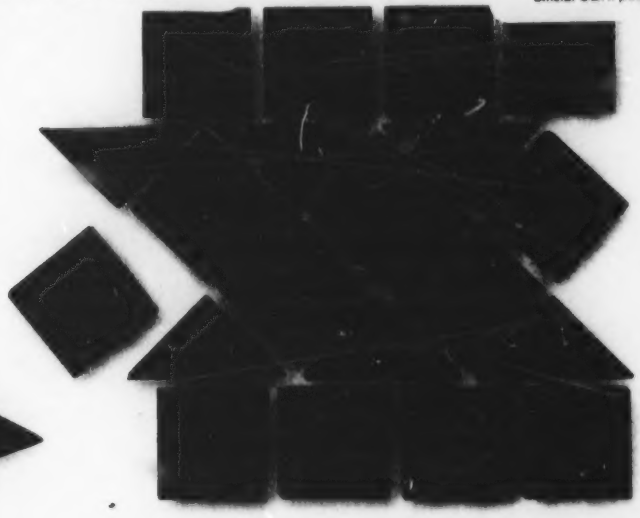

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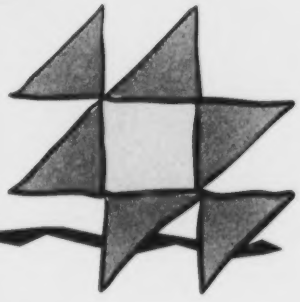
TexTile Math™



Multicultural Explorations through Patterns

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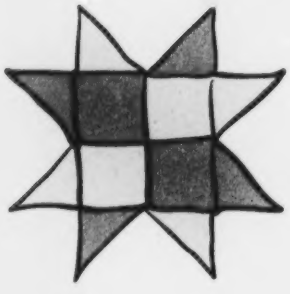

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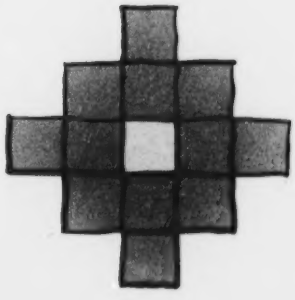

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For my Bubby Jessie, who made beautiful quilts.

— B F

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To the Teacher

TexTile Math™ is a series of open-ended challenges for students in grades 3 through 6. By solving questions related to beautiful textile designs, students discover that math and art are perfect partners. Using colorful squares and triangles called *TexTiles*™, students explore geometry, numbers, area, fractions, logic, and discrete mathematics. The multicultural themes throughout the book give the math concepts greater relevance and depth.

Components

TexTile Math features 34 reproducible student activities. Students build designs with TexTiles, record them on reproducible 1 cm grid paper (pages 69 and 70), and solve problems related to the designs. Crayons or markers should be available to record the designs.

The teacher page for each student activity includes *Historical Background*, (interesting facts about a culture), *Challenge* (a math problem using TexTiles), *Explorations* (a description of the activity), *Discoveries* (possible solutions), and *Questions* (class reflection and discussion).

Integral to the learning process is a colorful set of 7 *TexTile Math Posters* featuring designs from 7 "cultures" around the world. These 17" x 22" posters make an outstanding display and include photographs of people in traditional dress.

Introducing TexTiles

The TexTile squares and triangles are available in eight different colors. Student worksheets use different patterns to denote changes in TexTile colors and this color key:

r = red	**y= yellow**	**g = green**	**bk = black**
b = blue	**o= orange**	**p = purple**	**w = white**

Have students use free exploration time to discover the relationship between square and triangle TexTiles. They may study the attributes of the TexTiles (color, size, number), and how the TexTiles can be used to build patterns.

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Math Content

A wide range of math concepts arise naturally from building the multicultural designs with TexTiles. This book may include the following topics:

- counting
- geometric patterns
- polygons
- discrete mathematics
- symmetry
- number patterns
- area
- equivalent fractions
- comparing fractions
- combining fractions
- logic
- tessellations

Subject Integration

TexTile Math can be used as a unit. However, specific topics or activities can be completed effectively in isolation. You may find that certain activities fit into your social studies curriculum, and these can be pulled out and used at the appropriate times. Choose a book from the Student's Bibliography on page 71 to introduce and enhance the worksheets.

Seven "cultures" from around the world are represented in *TexTile Math*: Colonial American, Amish, Navajo, African, Hmong (from Thailand), Maya (from Guatemala), and Maori (from New Zealand). The designs and their colors were carefully researched for authenticity.

Studying the designs is a wonderful visual learning experience. Students may find it interesting to compare and contrast designs from all 7 cultures. Looking for similarities and differences will enhance their appreciation of the designs. The use of triangles and squares are seen in every culture. The zig zag, pinwheel, and star designs also appear in several cultures. Refer often to the *TexTile Math Posters* when making comparisons. Students can also share patterns from their homes.

Use the World Map on page viii and the maps on pages 1, 11, 21, 31, 41, 51, and 61 to help students identify the location of each of the cultures.

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Classroom Management

TexTile Math can be used in a variety of ways. Activities are appropriate for individual work, for partners or groups, for learning centers, and for whole class explorations. You can use any or all of these approaches, according to your needs.

Before introducing an activity, motivate students with intriguing information about a culture or fascinating facts about a design by reading aloud the Historical Background on the teacher page.

In most cases, there will be plenty of *TexTiles* for each student to build a design and complete a worksheet. Although traditional design colors are listed, other colors may be substituted. For more intricate designs, students can work in larger groups to build one design. Another way to facilitate sharing materials is to present the *TexTile Math* activities as part of a menu.

Technology

Instead of providing students with grid paper for copying traditional and original designs built with TexTiles, try computer graphics programs. Copying and creating designs using technology reinforces students' understanding of symmetry, patterns, geometric shapes, and angles.

Assessment

A special *TexTile Math* folder, portfolio, or section of a notebook will encourage children to communicate and expand their ideas using writing, pictures, or other means of recording. Circulating among groups, listening to students' responses to questions, and studying students' portfolios are effective ways of assessing understanding.

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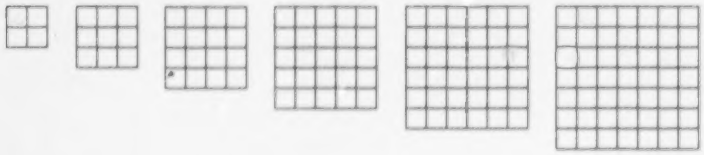
All About Quilt Patches

Quilting is a popular art form with a rich historical background. Along with the *TexTile Math Posters*, display a quilt or ask students to bring in quilts to share from home.

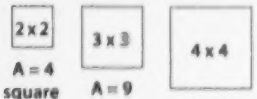
Many of the quilt patterns students are asked to build with TexTiles use a certain number of grid squares. The grid squares are called "patches." Show students a *4-patch* and have pairs cut out grid squares that are

4-, 9-, 16-, 25-, 36-, and 49-patches. Younger students can compare sizes:



Older students will notice perimeters and areas. They will find that the perimeters increase by 4:

They will find that the areas are 2 x 2, 3 x 3, 4 x 4, and so on.



Designing a Class Sampler Quilt

An enjoyable way to culminate the activities in *TexTile Math* is to make a class sampler quilt. Students can vote on which culture or mix of cultures they would like to represent. Then they can figure the dimensions of the finished quilt, and the size and number of patches each student would need to make to complete the quilt. After students build their patterns with *TexTiles* and record the designs on grid paper, patches can be cut out and glued onto a construction paper background. Display the quilt and play a guessing game. Students take turns describing any patch in the quilt. Others guess which patch is being described.

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World Map

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Colonial America

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Postage Stamp Puzzle

Historical Background

It wasn't easy for American pioneers to get cotton cloth to make quilts. The cotton had to be grown, picked, and made into thread. The thread was spun on a spinning wheel and woven into cloth. Then the cloth was dyed. The women in colonial America kept scrap bags filled with pieces of fabric. They would trade scraps with other women. Even the smallest pieces of cloth were saved. The Postage Stamp design could be made from the tiniest pieces in the scrap bag.

Challenge

Can you create a Postage Stamp design in which no color touches itself on a side or corner?

Explorations

1. Have students use 8 colors of TexTiles to build a 16-patch Postage Stamp design, as in the example on page 3. No color can touch itself on a side or corner.
2. Ask students to find other ways to build and record a 16-patch Postage Stamp design using only 4 colors. Each color must be used 4 times.

Discoveries

Designs will vary for the 16-patch using 8 and 4 colors.
Examples using 4 colors:

b	g	r	o
r	o	b	g
b	g	r	o
r	o	b	g

b	o	b	o
g	r	g	r
o	b	o	b
r	g	r	g

Questions

- What strategies did you use to solve this puzzle?
- Do you see any patterns using 4 colors?
- Compare designs. How many different designs were recorded?

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Postage Stamp Puzzle

Use all 8 colors of TexTiles.

Can you build a 16-patch Postage Stamp design?
No color can touch the same color on a side or corner.

Build this example:

bk	**b**	**g**	**o**
y	**o**	**p**	**w**
r	**g**	**bk**	**y**
b	**w**	**p**	**r**

Record on grid paper.

Find other ways to build a 16-patch Postage Stamp design using 4 colors. Each color must be used 4 times. No color can touch the same color on a side or corner.

Record on grid paper.

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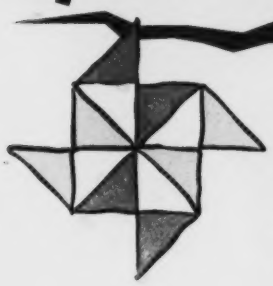
Symmetry Stars



Historical Background

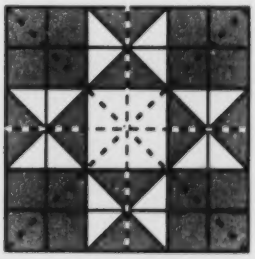
One quilting custom in colonial America was a girl could not get married until she had made 12 quilts. The thirteenth was her bridal quilt! The star was the most popular design in early American quilts. There are more than 100 ways to make stars on quilts. Look for the similarities and differences in the Martha Washington and Ohio Stars.

Challenge How many lines of symmetry can you find in colonial American star designs?

Explorations

1. Students use TexTiles to build star designs. They record their stars on grid paper.
2. Have students draw lines of symmetry through the designs.

Discoveries The Martha Washington Star and Ohio Star each have 4 lines of symmetry.



Ohio Star

Questions

- How many lines of symmetry did you find in each star?
- How did you figure out the lines of symmetry?
- Can you build a star design that has only 2 lines of symmetry?

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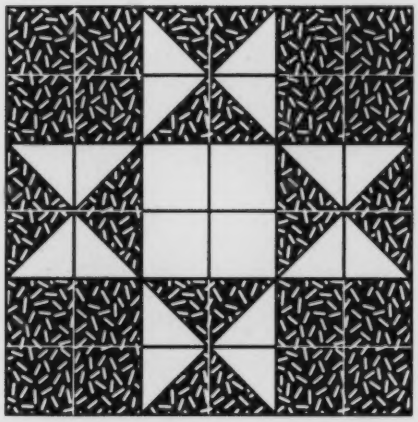
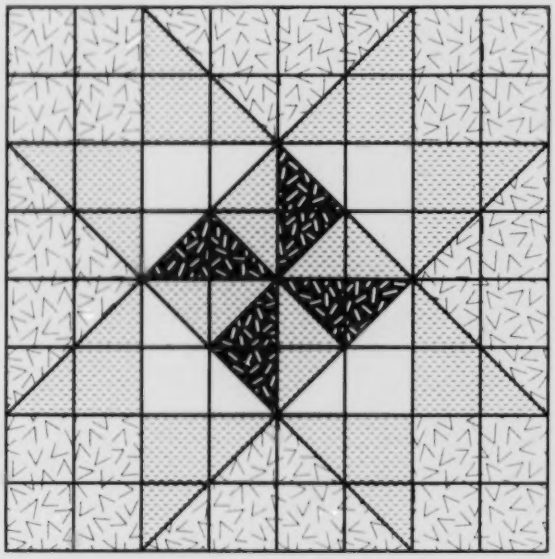
Symmetry Stars

Use any colors of square and triangle TexTiles.

Choose one of these star designs and build it.



Ohio Star



Martha Washington Star

Record on grid paper. Find and draw lines of symmetry through the stars.

Make your own star design.

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Log Cabin Fraction Puzzles

Historical Background

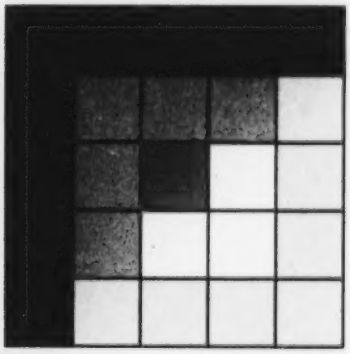
American pioneer women made quilts that used the Log Cabin pattern. There is often a red square in the center of the Log Cabin designs. This red square stood for the stove in the Log Cabin.

Challenge Can you use the fraction clues to make Log Cabin designs?

Explorations

1. Have students read fraction clues and use TexTiles to build 25-patch Log Cabin designs. They record the designs on grid paper.
2. Ask students to write fraction clues for a partner to make any size Log Cabin design.

Discoveries Designs will vary, but they should show the red square in the center of the 25-patch. Like colors should be together and form right angles around the red square as in this example:



Questions

- What strategies did you use to make the Log Cabin design?
- On the 25-patch, how do you know 7/25 is yellow?
- Can you make this Log Cabin design into an 81-patch? What colors of TexTiles would you need?

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Log Cabin Fraction Puzzles

What are the fractions for the colors in this Log Cabin design?

b	**b**	**b**
b	**r**	**o**
b	**o**	**o**

blue =

red =

orange =

Use TexTiles. Build a 25-patch Log Cabin design that is:

$\frac{1}{25}$ red

$\frac{3}{25}$ orange

$\frac{7}{25}$ yellow

$\frac{9}{25}$ purple

$\frac{5}{25}$ or $\frac{1}{5}$ blue

Record on grid paper.

Write a Log Cabin fraction puzzle for your partner to build.

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Octagons and Polygons

Historical Background

Colonial American octagon quilt patterns had unusual names. Swamp Patch, Basket Weave, and Courthouse Steps are just a few of the names. The names the quilters gave their designs came from nature, politics, religion, and everyday life. The padding for a quilt also came from nature: feathers, goose down, cattails, grass, corn husks, straw, and milkweed.

Challenge What polygons can you find in early American octagon designs?

Explorations

1. Have students identify polygons in the designs: squares, triangles, trapezoids, diamonds, quadrilaterals. They can build different polygons using TexTiles.
2. Students use TexTiles to build octagon designs. They record their octagons on grid paper.

Discoveries Examples of polygons:

Pentagon *Trapezoid* *Parallelogram* *Hexagon* *Octagons*

Basket Weave is made up of 4 quadrilaterals.

Swamp Patch has squares and triangles.

Courthouse Steps has triangles, trapezoids, and squares.

Questions

- What polygons did you find in each octagon?
- What is the same about the octagons? What is different?
- Can you record and label different polygons?

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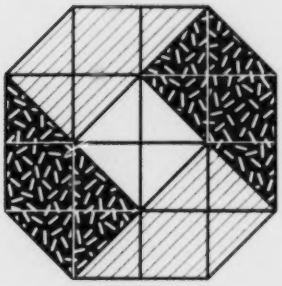
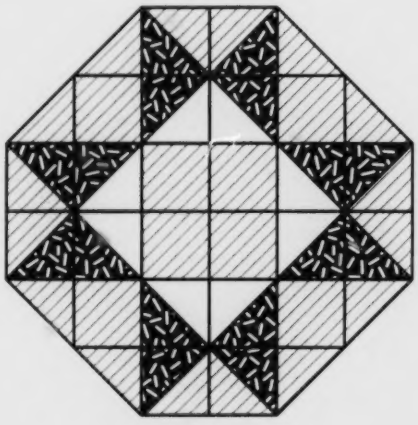
Octagons and Polygons

Use any colors of square and triangle TexTiles.

Choose one of these octagon designs and build it.



Basket Weave



Swamp Patch

Record on grid paper. Find different polygons in the octagons.

Build different polygons with TexTiles.

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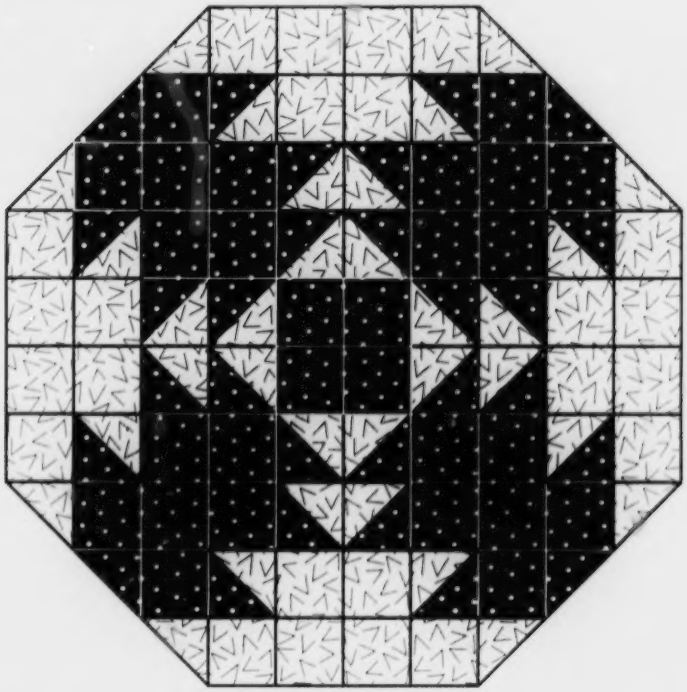
More Octagons and Polygons

Use any 2 colors of square and triangle TexTiles.

Build this octagon design:



Courthouse Steps

Record on grid paper. Find and name polygons in the octagon.

Compare this design with the octagons on page 9.

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Amish

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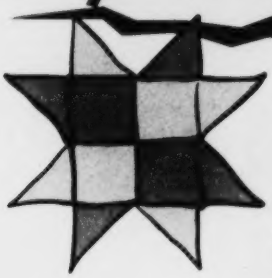
Mystery Designs



Historical Background

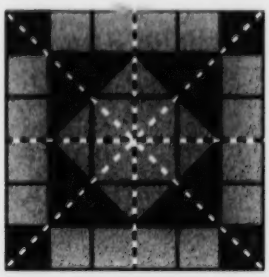
The Amish first came to America in 1727. They had escaped from Europe where they were punished for their religious beliefs. Today, the Amish live very simply in communities that are different from most of America's towns and cities. They use horses and buggies instead of cars. They plow their fields using mules and horses. They don't have television or even telephones. The Amish usually wear black clothes with no bows, buttons, or decorations. However, men's shirts and children's clothes are often made in bright solid colors. These bright colors are used in beautiful Amish quilts.

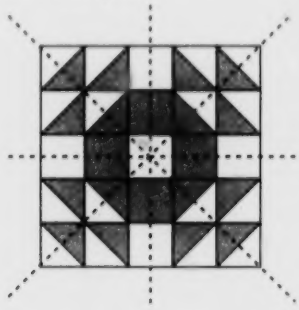
Challenge Can you complete an Amish quilt design?

Explorations

1. Have students use TexTiles to complete the designs. They should record their results on grid paper.
2. Have students find and draw lines of symmetry in the designs.

Discoveries There are 4 lines of symmetry in both designs:





Questions

- Was it difficult to complete the quilt designs?
- How many TexTiles did you need?
- How many lines of symmetry did you find? How can you tell when it is a line of symmetry?

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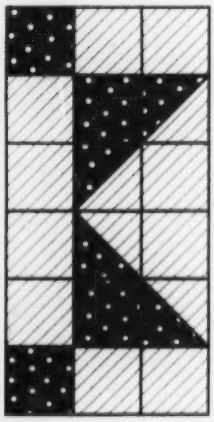
Mystery Designs

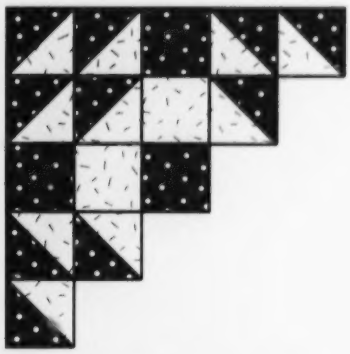
Use purple and blue TexTiles.

Complete this Amish design on a 36-patch:



Diamond in Square

Use purple and orange TexTiles. Complete this design on a 25-patch:



Single Wedding Ring

Record on grid paper. Find and draw lines of symmetry through the designs.

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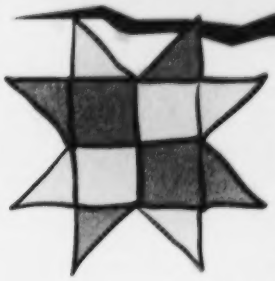
Fraction Fruit Basket



Historical Background

Large families are important to the Amish way of life. Children have many chores: milking the cows by hand, cutting and baling hay, planting and harvesting. Amish girls also learn to garden, gather eggs, preserve food, and sew.

Challenge Can you use fractions to build an Amish basket design?

Explorations

1. Have students use TexTiles and fraction clues to build a fruit basket.
2. Tell students to record their designs on diagonal grid paper. Then they can write fraction clues for partners to build a bow tie design.

Discoveries Colors will vary.
Bow tie fraction clues might be:

8/49 green
20/49 white
7/49 or 1/7 red
14/49 or 2/7 purple

Questions

- Who made identical baskets with the same colors?
- Was your partner able to complete the bow tie design using your fraction clues?
- Was it easy or difficult to write fraction clues? Why or why not?

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Fraction Fruit Basket

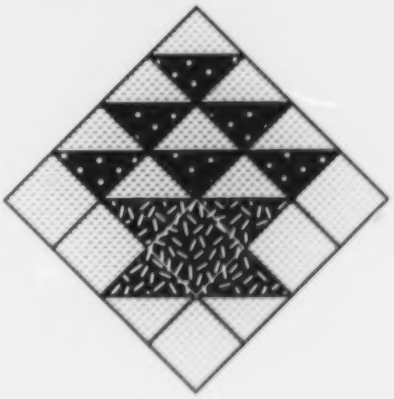
Use TexTiles to build a fruit basket design that is:

$\frac{10}{16}$ or $\frac{5}{8}$ yellow

$\frac{3}{16}$ purple

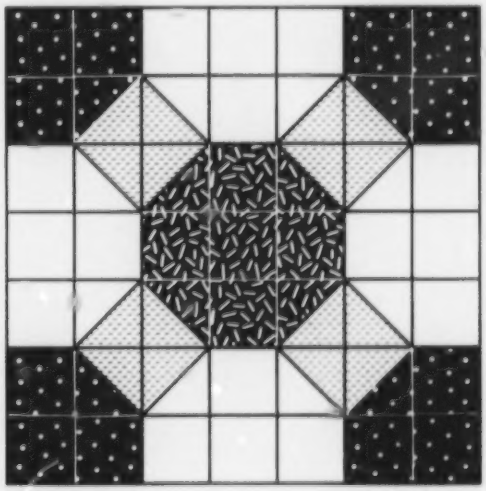
$\frac{3}{16}$ blue

Hint: 2 triangles = $\frac{1}{16}$



Record on grid paper.

Write fraction clues for a partner to build the bow tie design.
Record on grid paper.



Bow Tie

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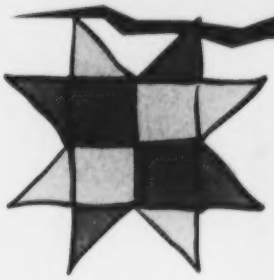
Fill a 4-Patch



Historical Background

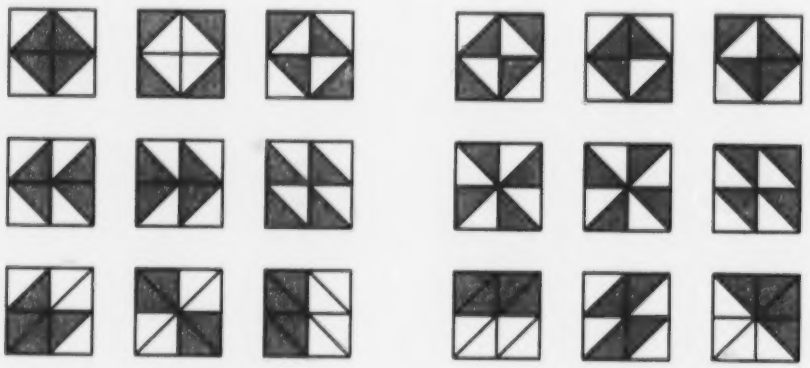
Quilting is a way for an Amish woman to display her skillful needlework. No two Amish quilts are identical. Quiltmakers save scraps from leftover fabric used to make their clothes. The scraps are cut into squares and triangles for later use. Most Amish designs are simple, using plain fabrics.

Challenge How many ways can you make a 4-patch with triangle TexTiles?

Explorations

1. Have students use 2 colors of triangle TexTiles to make different 4-patches. They should record their results on grid paper.
2. Tell students to write about how they know they have found all the possible ways.

Discoveries Encourage students to build as many designs as possible.
Examples:



Questions

- How many ways did you find to fill the 4-patch?
- How do you know you have found all the possible ways?
- Try filling a 4-patch using 4 colors of squares. How many ways can you find? (24 ways)

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Fill a 4-Patch

How many different 4-patches can you build using 2 colors of triangle TexTiles?

Here are two examples:

Broken Dishes

Wild Goose Chase

Record on grid paper.

Write how you know you have found all the possible ways.

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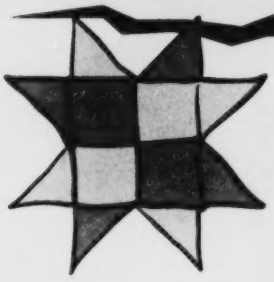
Tessellating Triangles



Historical Background

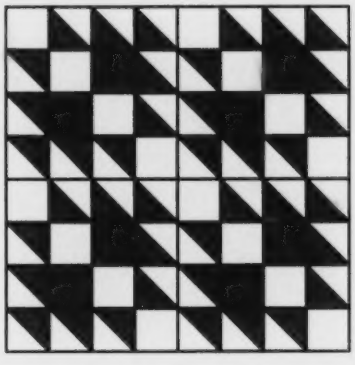
A warm quilt has three layers—the top, the padding, and the bottom. Amish women and girls sew together patches for the top of the quilt at home using treadle sewing machines (powered by pressing a pedal with a person's feet). Then they get together for a quilting bee called a "frolic." At the frolic, they sit around large wooden frames and sew the layers together by hand. They can finish as many as six large quilts in one day!

Challenge Can you tessellate an Amish quilt design?

Explorations

1. Have students use 2 colors of triangle TexTiles and tessellate 16-patches. Tessellating means to continue a design without overlapping any patterns. They should record their results on grid paper.
2. Ask students to compare their tessellations. Tessellations may be continued if students tape sheets of grid paper together.

Discoveries Example:



Questions

- How did you tessellate each design?
- Compare designs. Does everyone's tessellation look the same?
- Is one color in your design more than or less than half the design?

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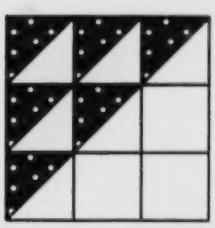
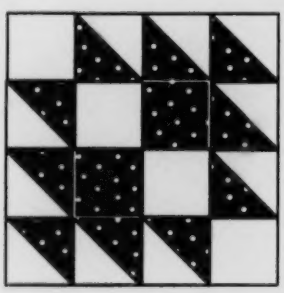
Tessellating Triangles

Choose one design. Tessellate the design.



Birds in the Air



Double X

Record on grid paper.

How many times did you repeat the design?

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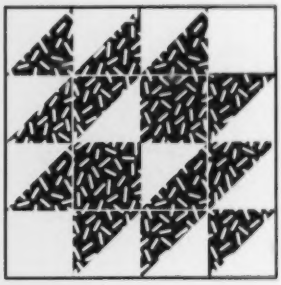
More Tessellating Triangles

Use any color of TexTiles.

Tessellate this design:



Mosaic

Record on grid paper.

Compare your tessellation with a classmate's. Are they the same or different?

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Navajo

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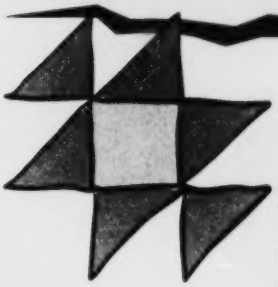
Surrounding Designs



Historical Background

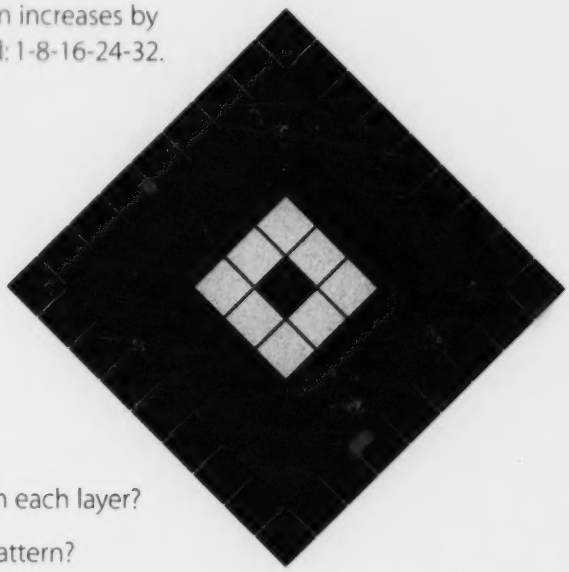
There is a very old Navajo story about weaving. In the story, Spider Man teaches the Navajo men how to make a loom. The loom is made out of sun rays, lightning, and crystals. Then, Spider Woman teaches the women of the tribe how to weave. When a baby girl was born, a Navajo mother would rub spider webs on the baby's arms and legs so she would be a good weaver.

Challenge How many TexTiles will you need to add a new layer to a design?

Explorations

1. Have students use TexTiles to make a surrounding design. They predict how many TexTiles they will need to complete a layer and record their results on diagonal grid paper. Explain to students that a layer is a group of TexTiles that form a square or rectangle (a ring) around the middle of a design.
2. Tell students to write about what they found out.

Discoveries Students will find the design increases by 8 each time a layer is added: 1-8-16-24-32.



Questions

- How many squares are in each layer?
- Did you figure out the pattern?
- What shape does each layer form?

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Surrounding Designs

Use black, yellow, green, and red square TexTiles.

Build a surrounding design. Start with 1 black TexTile.

Add a layer of yellow. How many TexTiles will you need?

Add a layer of green. How many TexTiles will you need?

Add a layer of red. How many TexTiles will you need?

Add a layer of black. How many TexTiles will you need?

Record on grid paper.

Write about the patterns you find. Make your own surrounding design.

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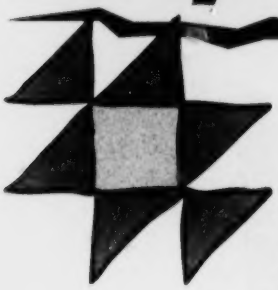
Navajo Zig Zag



Historical Background

The Navajo women raised sheep for their wool. They would trade most of the wool for food. It took months to save enough wool to make blankets. Hours were spents coloring yarn with vegetable dyes. The brown and white in the blankets were the natural colors of the wool. The blue was from the indigo plant. A blossom from the rabbit brush made a yellow dye. Black came from sumac. Navajo girls today need years to learn weaving. Men have also become good weavers.

Challenge Can you make a Navajo zig zag design?

Explorations

1. Have students use TexTiles to build a zig zag design. (Grid lines are not shown on this design.) Students will find that it might be easier to record the design if the grid paper is horizontal. (They can also tape together 2 sheets of grid paper to extend the design.)
2. Have students compare their designs and describe how they are different.

Discoveries Designs may vary in color and length.

Questions

- How many centimeters long is your zig zag?
- How many triangles did you use?
- Did anyone build a different zig zag?

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Navajo Zig Zag

Use any colors of TexTiles.

Build this Navajo design.

Record on grid paper.

Build another zig zag design.

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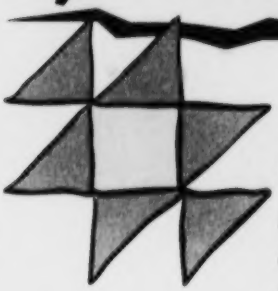
Eye-Dazzlers



Historical Background

It is important for the Navajo to create hozho, which means beauty, balance, and harmony. The first blankets the Navajo wove had simple designs on them, with a few stripes of color. After the railroads were built, trade between the eastern and western United States expanded. There was a growing market for crafts made by Navajos. Navajo women were able to buy dyes and yarn that were ready to use. Some of the blankets the Navajo made from these new colors were so bright and colorful, they were called "Eye-Dazzlers."

Challenge Can you make a Navajo Eye-Dazzler?

Explorations

1. Have students use TexTiles to build an Eye-Dazzler.
2. Tell students to record their designs on grid paper. Then they should write an equation that proves the design is a 49-patch.

Discoveries The completed design may have:
3 orange squares, 2 green squares, 4 black squares, 14 orange triangles, 40 black triangles, 20 green triangles, and 6 yellow triangles.

80 triangles = 40 squares + 3 + 2 + 4 = 49 square centimeters

Questions

- Can you draw a line of symmetry through your design? (2 diagonal lines)
- Does your equation shows that the design is a 49-patch?
- How is an Eye-Dazzler like a surrounding design?

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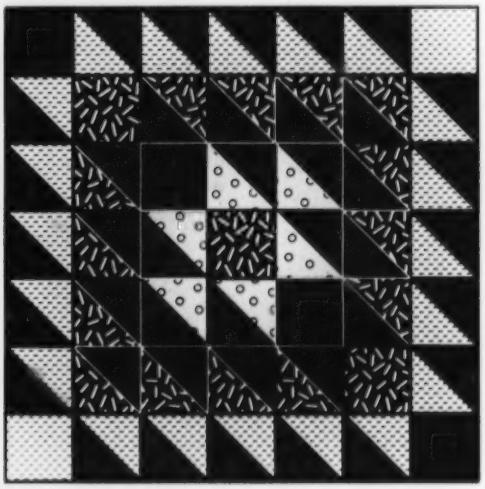
Eye-Dazzlers

Use black, orange, yellow, and red TexTiles.

Build this Navajo Eye-Dazzler:



Record on grid paper.

Write how many squares and how many triangles you needed of each color. Write an equation to prove the design is a 49-patch.

37

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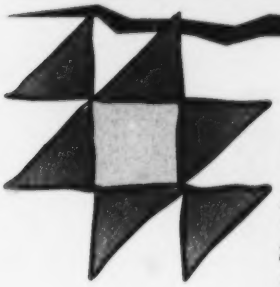
Traditional Tessellations



Historical Background

The Navajo used their blankets in many ways. They were sometimes used for sitting and sleeping. They were hung across the doorways of their hogans, or houses. They served as saddle blankets for horses. Women and girls sewed two blankets together to make a "dress." Today, the Navajo still wear these dresses on special occasions. Many blankets are sold for decoration.

Challenge Can you tessellate a Navajo design?

Explorations

1. Have students use TexTiles to build a Navajo design.
2. Tell students to tessellate the pattern. Explain that tessellating means to repeat a design without overlapping any shapes. Have students record their tessellations on grid paper. Ask them to estimate the number of squares they would need to double the size of the design.

Discoveries The number of squares will vary depending on how far the tessellations are extended.

Questions

- How did you tessellate the design?
- Are more than 1/2 the squares white (red)? How can you tell?
- Do you think your doubling estimation is correct? How can you tell?

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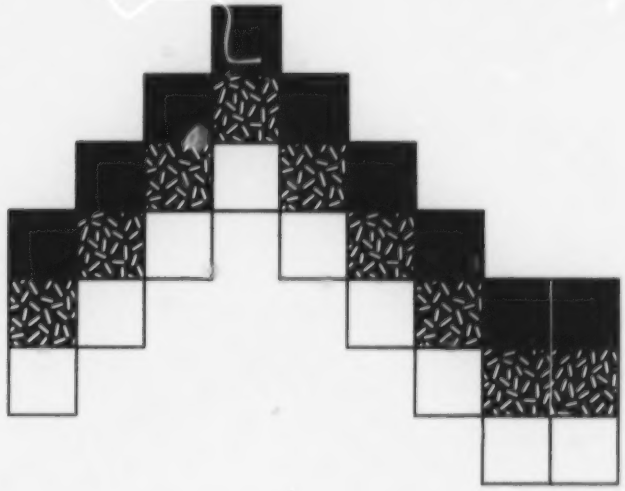
Traditional Tessellations

Use red, white, and black TexTiles.

Tessellate this design:



Record on grid paper. How many squares would you need to double your tessellation?

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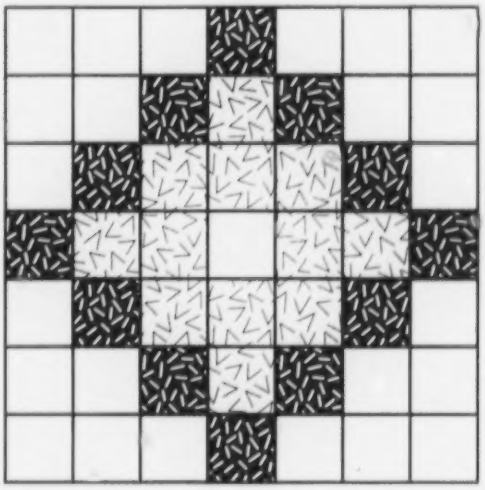
More Traditional Tessellations

Use any 3 colors of TexTiles.

Tessellate this Navajo Surrounding Design:



Record on grid paper. How many squares will you need to double your tessellation?

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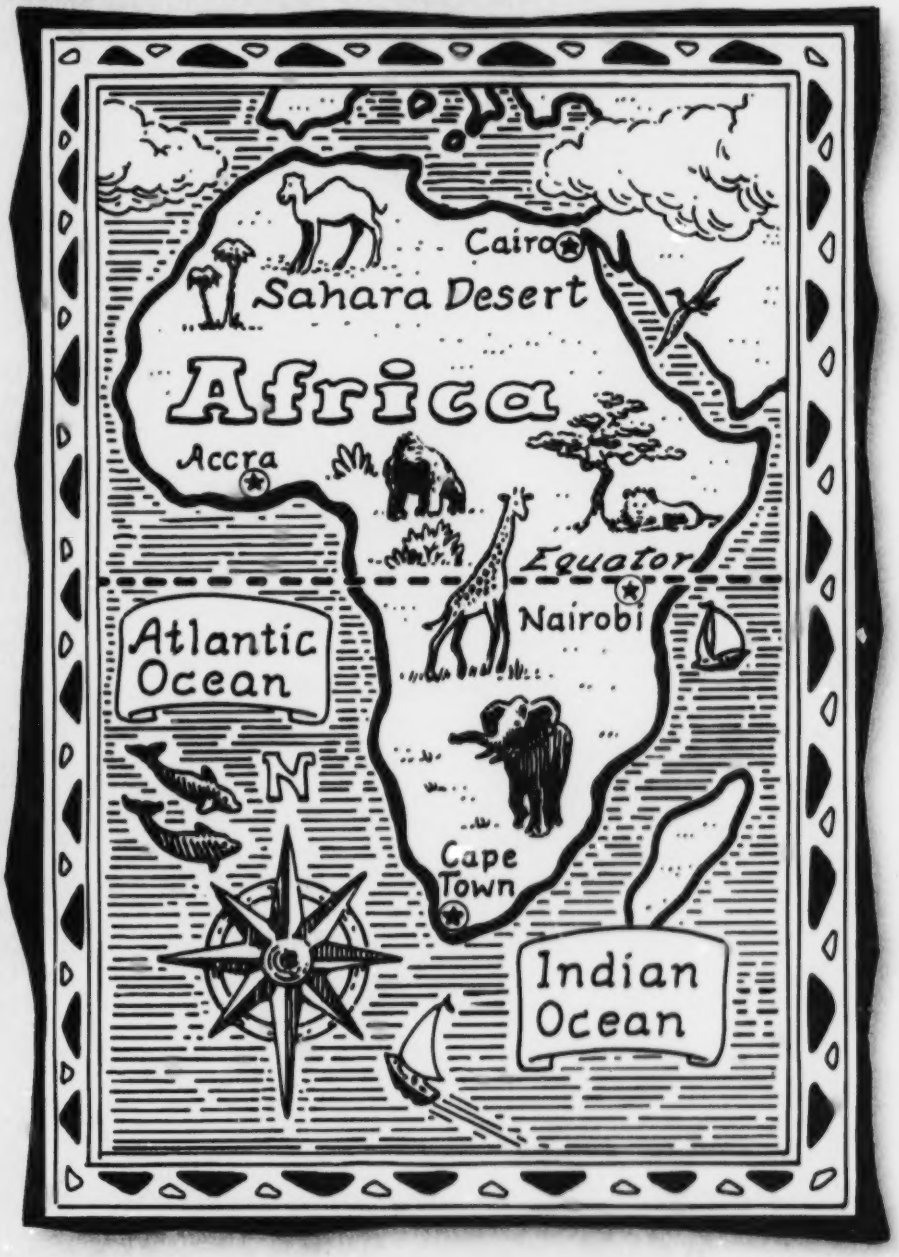
Africa



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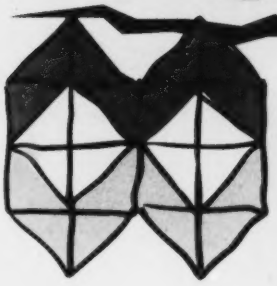
Triangle Hunters



Historical Background

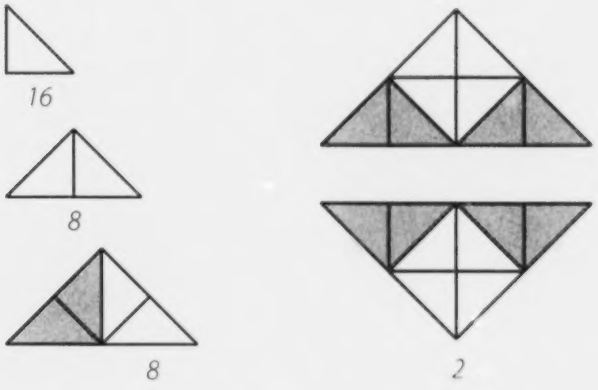
Shapes in African designs can have special meanings. For some tribes in Nigeria, black and white triangles can mean leopard spots. Some colors and shapes stand for gods and goddesses. Sometimes secret writing is a part of an African design. This could be painted, sewn, woven, stamped or dyed into the fabric.

Challenge How many triangles can you find in a design?

Explorations

1. Students use black and white TexTiles to build and record the design.
2. Students count and record as many triangles as they can find.

Discoveries There are 34 triangles in all:



Questions

- What different sizes of triangles did you find in the design?
- How did you keep track of the triangles you found?
- What was the trickiest part of this puzzle?

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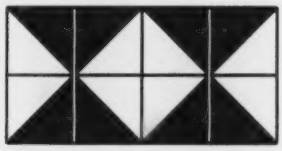
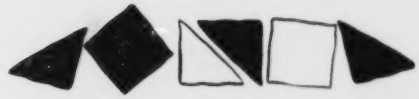
Triangle Hunters

Use black and white TexTiles.

Build this design:



Record on grid paper. How many triangles can you find?



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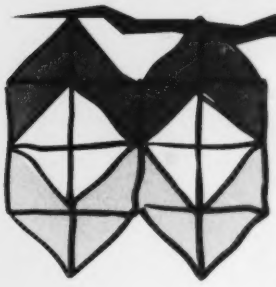
Pinwheel Patterns



Historical Background

Men are the weavers in many African tribes. They have long narrow looms that they carry with them. They weave in strips and then sew the strips of cloth together. The pinwheel designs are bright and bold. Africans can tell how important and rich people are by their clothing. A king or chief in Africa has many designs on his clothing.

Challenge What happens when you turn a pinwheel design?

Explorations

1. Have students use TexTiles to build pinwheels. They record their designs on grid paper.
2. Tell students to cut out designs and rotate them. Students can write about what they see when a design is rotated 2 or more times.

Discoveries Students will find that all pinwheels have blades that seem to move when turned around. The 16-patch design looks the same when rotated; the 8 x 6 design looks the same after two rotations.

Questions

- What is the trickiest part of building an African pinwheel design?
- What is the same about both the pinwheel designs?
- What did you notice when you rotated the pinwheels?

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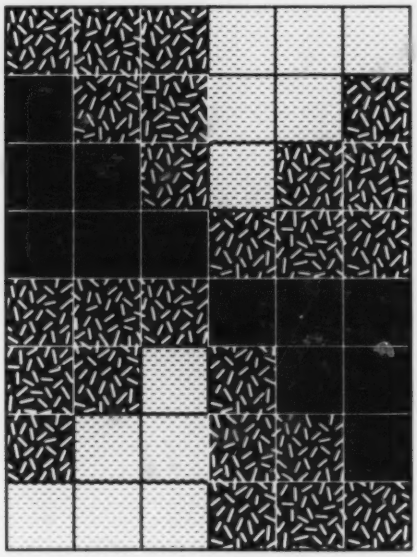
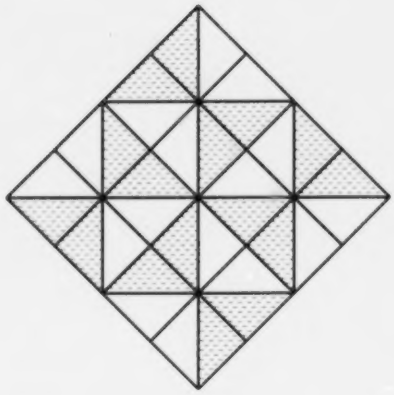
Pinwheel Patterns

Use TexTiles.

Build these pinwheel designs:





Record on grid paper. Cut out the designs. Rotate them and see what happens.

Make your own pinwheel design.

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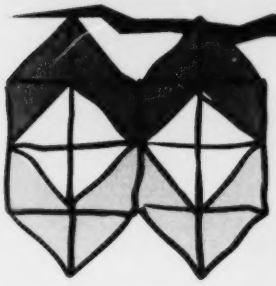
Black and White Puzzle



Historical Background

In Africa, designs are found on many objects besides clothing. Baskets, mats, and dishes also contain designs. Houses are painted inside and out with geometric patterns. Some paints are made with coal tar that has been mixed with sand and boiling water. Clay or limestone mixed with colored pigments is also used.

Challenge How does color change an African design?

Explorations

1. Students use TexTiles to build the Black and White design. They reverse the white and black TexTiles and record the new designs on grid paper.
2. Have students try other colors in the design.

Discoveries Colored designs will vary. Students need to note positions and colors of the triangles and zig zags while building the design.

Questions

- Can you tessellate the pattern?
- What was different about the design when you changed the colors?
- What polygons can you identify in the pattern?

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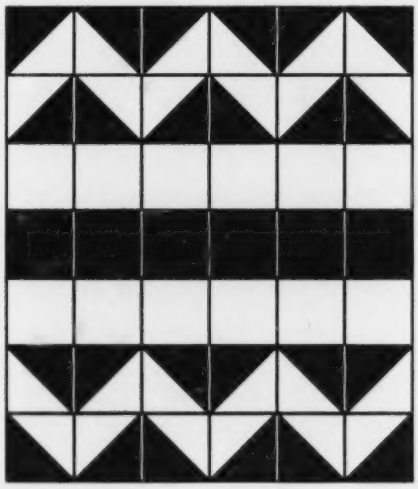
Black and White Puzzle

Use black and white TexTiles:

Build this African design:



Switch the black and white TexTiles in this design. Record on grid paper.

How has the pattern changed?

Build the design using 2 different colors of TexTiles.

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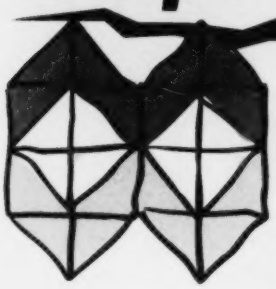
Shape Safari



Historical Background

There is often a surprise in the bright colors and geometric shapes in an African design. The design may be black, yellow, black, yellow, and suddenly the pattern is broken! A yellow square appears where a black square should be. In Africa, it is believed that a broken pattern keeps away evil spirits.

Challenge Can you tessellate the African designs?

Explorations

1. Students use TexTiles to build a design. Have students identify the yellow shape (hexagon) in the pattern.
2. Ask students to tessellate the design and record it on grid paper. Then students can try the design on page 40.

Discoveries Tessellating the hexagon and triangle pattern makes a beautiful design! Encourage students to continue the pattern and fill the page. Page 40 may reveal an octagon shape if red squares are made with triangles.

Questions

- What shapes did you discover?
- Can you tessellate each design a different way?
- How might you break the pattern in each design?

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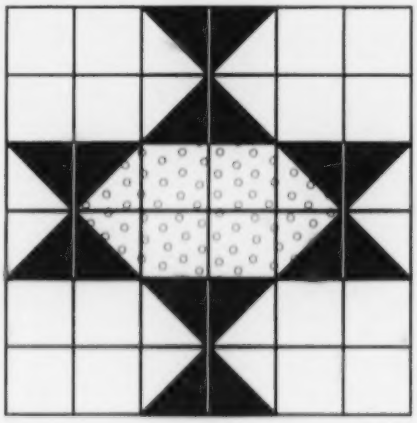
Shape Safari

Use black and yellow TexTiles:

Build this design:



Record on grid paper.

Choose one section in the design. How many sides does it have?

What is the name for the shape? Tessellate the design.

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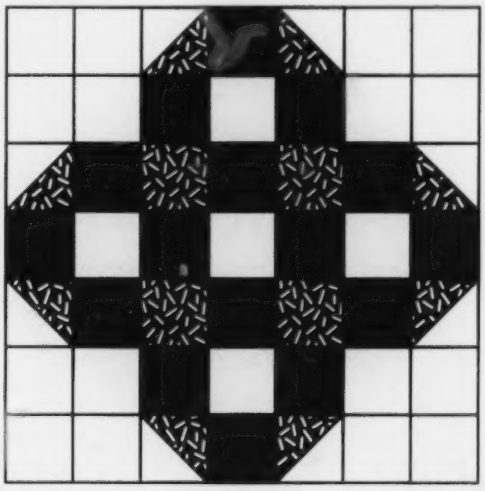
More Shape Safari

Use black, red, and white TexTiles.

Build this design:



Record on grid paper.

Choose one section in the design. How many sides does it have?

What is the name for the shape? Tessellate the design.

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Hmong

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Break the Code

Historical Background

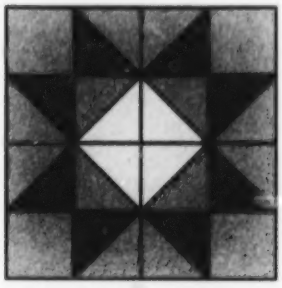
The Hmong (Mung) have been a part of Chinese history for 4,000 years. They migrated to Laos from southern China 150 years ago. Some groups still live in China, others are in North Vietnam and in the mountains of Northern Thailand. Hmong means "free people." They have fought to keep their freedom. The Hmong are famous for their embroidered clothing. Detailed designs are embroidered on aprons, hats, and on the collars of the black jackets worn by men and women.

Challenge Can you build a Hmong design using a code?

Explorations

1. Have students use a code to build a Hmong design with TexTiles.
2. Students should record their designs on grid paper and then write a new code for a partner to follow.

Discoveries The completed design should look like this:



Questions

- Were you able to use the code to build the design?
- How many TexTiles did you use to complete the design?
- How did you make a new code to complete a different design?

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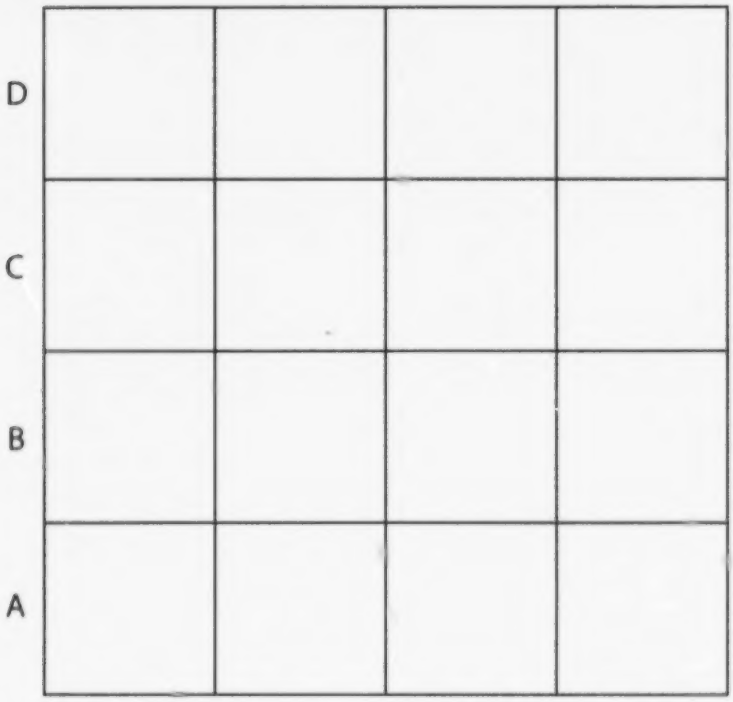
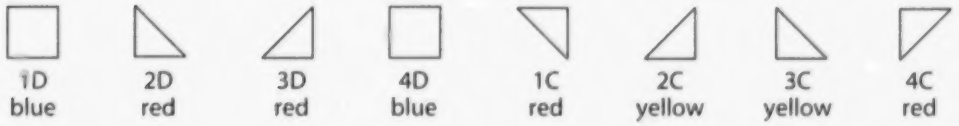
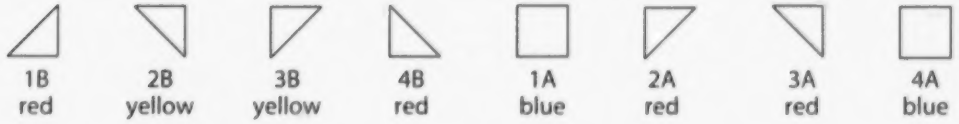
Break the Code

Use the code to build a Hmong design on this grid:







Fill in the remaining 16-patch with blue triangle TexTiles.

Make your own design on a piece of grid paper. Write a number, letter, and color for the square or triangle you draw. Have a partner follow your code.

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Mystery Tiles

Historical Background

There is only one Hmong clan in a village of two to forty houses. The oldest person in the village is usually the chief. The clan is very important to the Hmong. Every clan has a traditional design on their clothing. The Laotians name the Hmong clans by their clothing: White Hmong, Flowered Hmong, Striped Hmong.

Challenge Can you find the missing TexTiles to complete a design in which both sides match?

Explorations

1. Students use TexTiles to build and complete a design in which both sides match. There are no grid lines showing.
2. Students record the completed design on grid paper.

Discoveries The completed design may look like this:

Questions

- What strategies did you use to complete the design?
- Can you draw a line through the center of your design to show that both sides match?
- Was the design easy or difficult to complete? Why?

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Mystery Tiles

Use any colors of TexTiles.

Build this design:

Complete the design. Record on grid paper.

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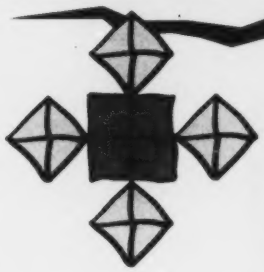
What's the Angle?



Historical Background

The Hmong woman's formal costume shows her sewing skills and the wealth of her family. Each girl must sew and embroider a heavy pleated skirt that may be 20 feet (6 meters) at the hem. On her head, a girl wears her clan's headdress trimmed with yarn or striped with colored bands. She also wears silver necklaces and bracelets.

Challenge Can you record a Hmong design that shows right angles?

Explorations

1. Students build a right angle from 3 square TexTiles.
2. Ask students to write directions for using right angles to build the design pictured at the bottom of page 47.

Discoveries Students should describe the pattern as having 3 blue, 3 green, and 6 white right angles. The directions should include how the angles are turned in different ways to create the design.

Questions

- What directions did you write to show how to build the design?
- What different designs could you make using the right angle pattern?
- Could you tessellate this design?

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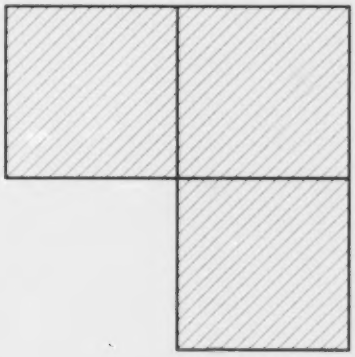
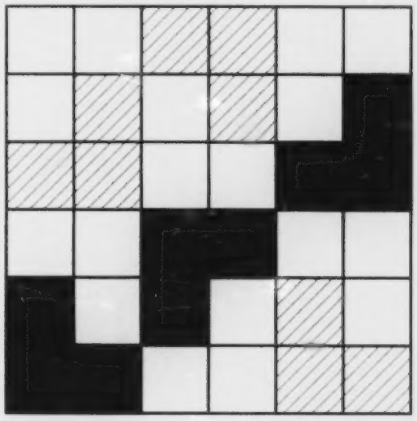
What's the Angle?

Use blue, green and white TexTiles.

Build this design:



Write directions that describe how to make this Hmong design:



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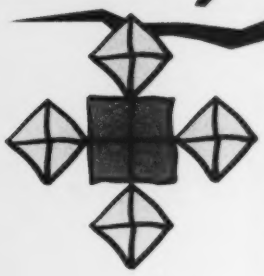
Fancy Fractions



Historical Background

Usually Hmong men and women wear loose, black shirts and pants. On holidays, the Hmong dress in very fancy clothes. They often add pompoms and silver decorations to their clothes. On New Year's the young girls and boys dress up. Then they line up in two rows. Boys and girls throw a black cloth ball to someone they like. This is how some find girlfriends or boyfriends!

Challenge Can you find and name fractions in Hmong designs?

Explorations

1. Students use TexTiles to build and record a Hmong design. They find a fraction to describe the colors in the design.
2. Students build another design and find fractions to describe the colors in the design.

Discoveries These fractions describe the designs:

Page 49
blue: 12/36 or 4/12 or 1/3 (red and white are the same as blue)

Page 50
blue: 20/36 or 10/18 or 5/9
(red and white: 16 triangles = 8 squares = 8/36 or 4/18 or 2/9)

Questions

- What strategies did you use to find the fractions?
- What fraction of each design is blue (red/white)?
- Did anyone get two different answers for the same design? Why?

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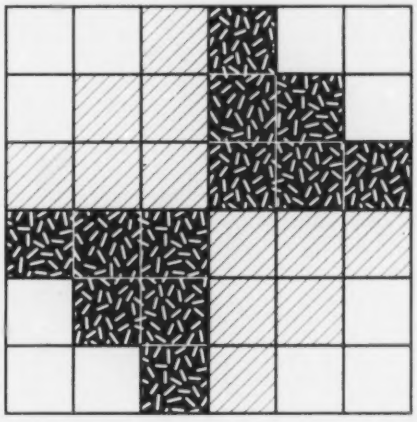
Fancy Fractions

Use red, white, and blue TexTiles. Build this design:



Record on grid paper.

Name fractions to describe the red, white, and blue part of this design.

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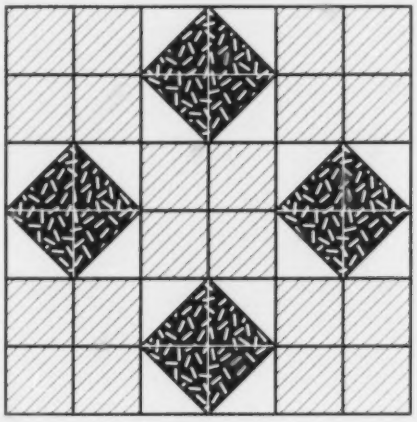
More Fancy Fractions

Use red, white, and blue TexTiles. Build this design:



Record on grid paper.

Name fractions to describe the red, white, and blue part of this design.

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Maya

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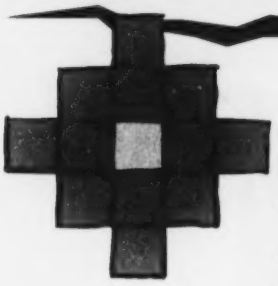
Build a Maya Man



Historical Background

The Maya have lived in Guatemala for 3,000 years. They also live in Mexico and in other places in Central America. Many of the Maya still dress the way they used to long ago. They wear very bright colors. The designs often show the moon, stars, flowers, people, and animals.

Challenge How many polygons can you find in a Maya design?

Explorations

1. Students use TexTiles to build a Maya man (no grid lines are showing). They record their designs on grid paper.
2. Have students find and name polygons in the Maya man design.

Discoveries Students will need to create the design on a 64-patch (8 x 8). These TexTiles can be used: 10 black squares, 4 black triangles, 15 red (or green) squares, and 12 red (or green) triangles. Students may find these polygons: rectangle, square, trapezoid, triangle, parallelogram.

Questions

- How many triangle TexTiles would it take to complete your design?
- Did someone use a different number of TexTiles to complete the Maya man?
- Is the design symmetrical? What changes would make it symmetrical?

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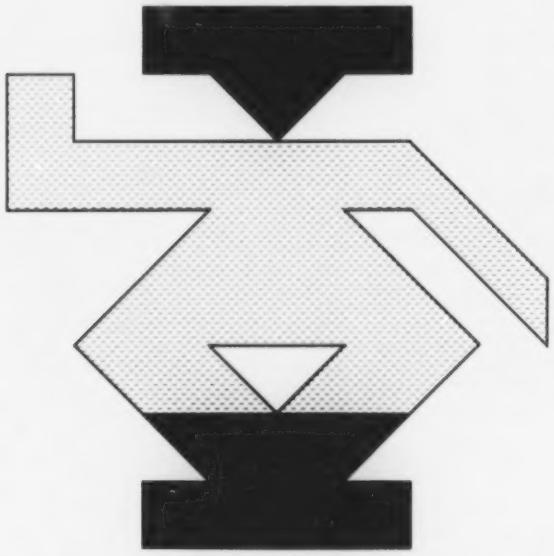
Build a Maya Man

Use red (or green) and black square and triangle TexTiles.

Can you build this Maya man?



Record on grid paper.

How many different polygons can you find and name in the design?

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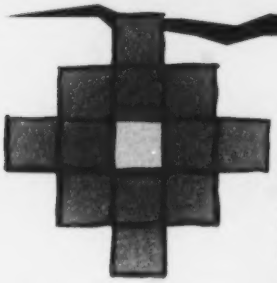
Build a Maya Design



Historical Background

Studying the clothing of the Maya is like looking through a history book because many of the designs have been passed down for 3,000 years. The Maya used a system of hieroglyphics, or pictures, to write. It's possible some of their clothing designs were once used in picture writing.

Challenge Can you rebuild a Maya design with missing TexTiles?

Explorations

1. Partners use TexTiles to build a design. One person removes half the TexTiles. Can the partner rebuild the design with TexTiles without looking at a picture clue?
2. Students experiment with other designs, removing TexTiles and having a partner rebuild the design.

Discoveries Partners may have to give clues to show how to rebuild the design. Timing each partner on how long it takes to rebuild the designs is a fun game!

Questions

- Can you tessellate this design?
- Can you use the same TexTiles and create another design for your partner to build?
- Was it easy or difficult to complete the design after the TexTiles were removed?

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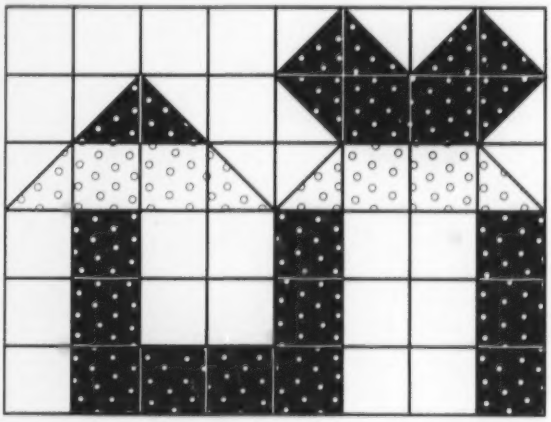
Build a Maya Design

Use TexTiles to complete this Maya design:



Remove half of the TexTiles and have your partner rebuild the design without looking at this page.

Make a new pattern with TexTiles. Remove some TexTiles. Have your partner rebuild it.

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Maya Magic

Historical Background

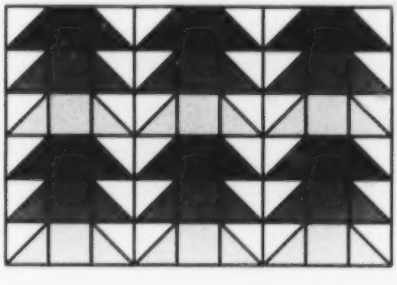
The moon goddess ixchel (Ishell) was also the goddess of weaving. Weaving was sacred and could only be done in a special building. Women wove cotton cloth on a backstrap loom. The weaver pulled the threads on the loom tight using the strap around her back.

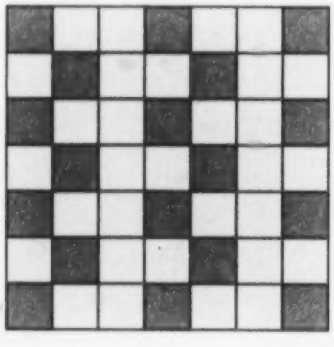
Challenge Can you tessellate a Maya design?

Explorations

1. Have students use TexTiles to tessellate a Maya design.
2. Tell students to record their tessellations on grid paper.

Discoveries Designs may look like these:





Questions

- Which design was the easiest to tessellate? Why?
- Can you use other colors to tessellate the design?
- How are the designs similar? How are they different?

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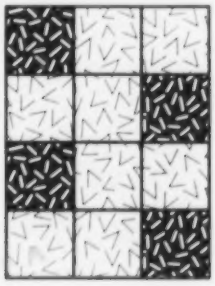
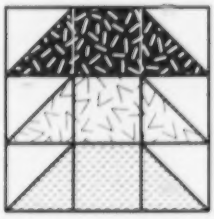
Maya Magic

Use any colors of TexTiles.

Choose one design. Can you tessellate it?





Record on grid paper.

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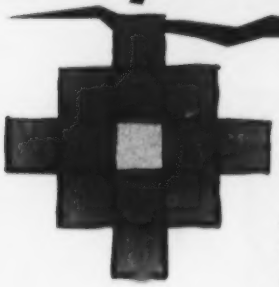
Maya Weavings



Historical Background

Maya women wear a "tzut," a long ribbon of narrow, handwoven cloth, wound around and around the head like a turban. They also wear "huipiles," blouses woven with beautiful designs. A "kub" is a dress made from a single piece of cloth with openings for arms and head. You can tell which village people are from by what they are wearing. Each village has its own special designs.

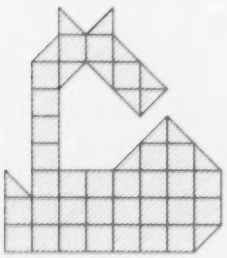
Challenge Can you build Maya animal designs?

Explorations

1. Have students use TexTiles to create a Maya cat design (no grid lines are showing).
2. After students record their designs on grid paper, have them find the area of the cat design. They can record the area as a number of squares or square centimeters. Then have students find the area of the horse design (no grid lines are showing) on page 60.

Discoveries The cat design on page 59 should be completed on a 7 x 8 grid.

The horse design on page 60 should be completed on a 9 x 8 grid.



Questions

- Were you able to create the design without seeing any grid lines?
- What is the total area of the cat design? (56-1/2 sq. cm.) What is the total area of the horse design? (38-1/2 sq. cm.)
- What method did you use to find the area?

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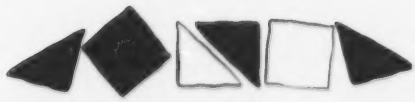
Maya Weavings

Use any colors of TexTiles.

Can you build this Maya cat design?

Record on grid paper.

What is the area of the cat design?



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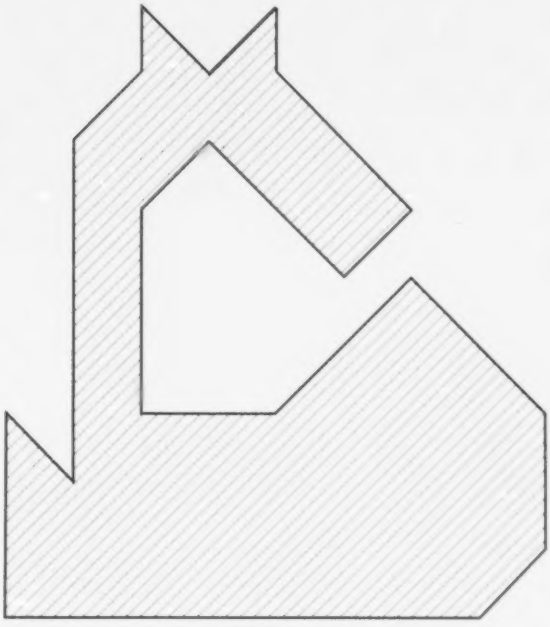
More Maya Weavings

Use blue TexTiles.

Can you build this Maya horse design?



Record on grid paper.

What is the area of the horse design?

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Maori

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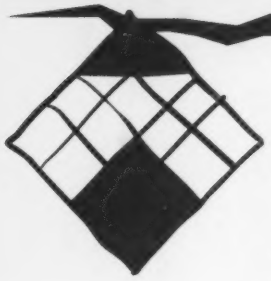
Dazzling Diagonals



Historical Background

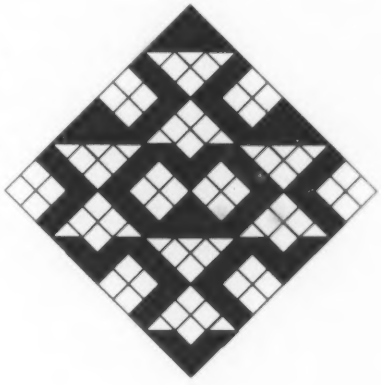
The Maori were the first people to live in New Zealand. They came from the islands of Polynesia. In Polynesia they made their clothes from the bark of a special tree. But this tree wouldn't grow in New Zealand. They grew flax instead. Maori women used shells to scrape the leaves of flax plants. This separated the leaves into fibers. Before weaving, women pounded the fibers with stones. The fibers were soft, but strong. The fibers were dyed with the berries, bark, and gum of the Hinau tree.

Challenge Can you tessellate a Maori design?

Explorations

1. Have students use TexTiles to build a Maori design.
2. Tell students to record four of the same design on diagonal grid paper, page 70. Have them cut out the designs and fit them together in a diamond pattern.

Discoveries Designs may look like these:



Questions

- What size patch did you make when you fit the 4 designs together?
- How many more patches would you need to make the design into a larger diamond?
- How large would the patch be if students put all their diamonds into one pattern?
- Is there another way to tessellate this design?

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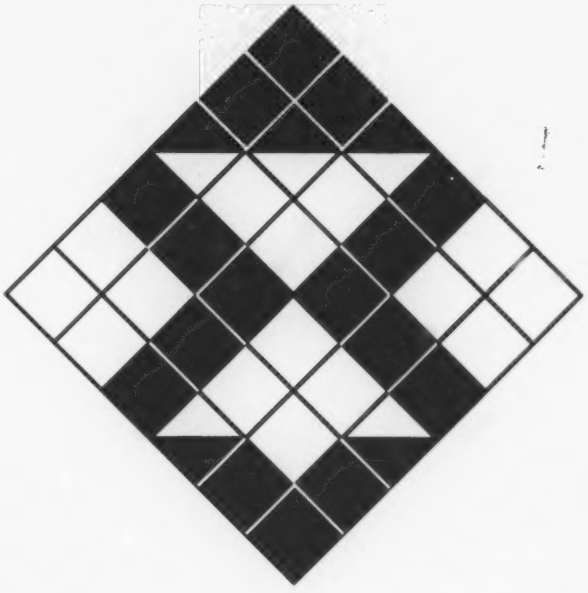
Dazzling Diagonals

Use black and white TexTiles.

Build this Maori design:



Record the design 4 times on diagonal grid paper. Cut out the designs and fit them together to make a diamond shape.

Can you change the design by rotating the 36-patches?

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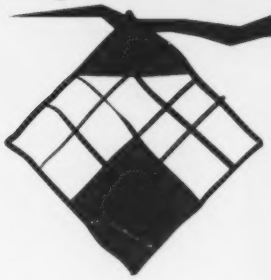
Symmetry Search



Historical Background

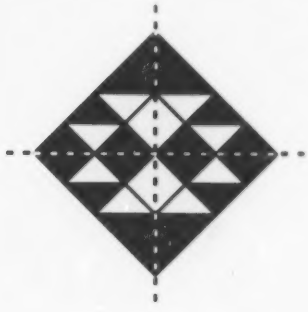
The Maori began weaving using only their hands and threads. They didn't use looms or tools. Maori designs use diagonal lines. The shapes are mostly triangles, diamonds, and pyramids. Taniko is the name for a border made with geometric patterns in different colors. The main colors are black, white, red, and yellow. Bird feathers and dog fur were often used in Maori weavings.

Challenge Can you find lines of symmetry in a Maori design?

Explorations

1. Have students use TexTiles to build a Maori design (no grid lines are showing).
2. Tell students to record their designs on diagonal grid paper. Then they draw lines of symmetry.

Discoveries Lines of symmetry may be drawn as follows:



Questions

- How many lines of symmetry could you find?
- Was it easy or difficult to build the pattern without seeing the grid lines?
- How could you change the design to have no lines of symmetry?

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Symmetry Search

Use black and white or red and yellow TexTiles.

Build this design:

Record on grid paper. Draw lines to show symmetry.

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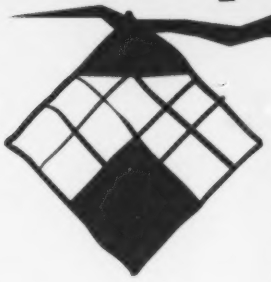
Multiple Weavings



Historical Background

The Maori had strict rules for weaving. Only certain women could weave. These women took part in a ceremony with a priest before they could become weavers. Special clothes could only be woven during the day. At sunset, the weaving had to be rolled up, but all cloaks and kilts could be woven at night. Strangers were not allowed to watch any weaving.

Challenge Can you figure out the number of squares and triangles you need to enlarge a pattern?

Explorations

1. Have students use TexTiles to build Maori designs.
2. Tell students to record the designs on grid paper. Then they find out how many squares and triangles they would need to make a certain number of patches.

Discoveries Page 67: (colors may vary.)

First 16-patch
10 red squares
2 red triangles
4 white squares
2 white triangles

Eight 16-patches
80 red squares
16 red triangles
32 white squares
16 white triangles

Second 16-patch
12 red triangles
4 white squares
12 white triangles

Twelve16-patches
144 red triangles
48 white squares
144 white triangles

Page 68: (colors may vary.)

64-patch
30 red squares
28 white squares
6 white triangles
6 red triangles

Four 64-patches
120 red squares
112 white squares
24 white triangles
24 red triangles

Questions

- How did you figure out the amount of TexTiles you needed to make more patches?
- Can you name a fraction for each color in the design?

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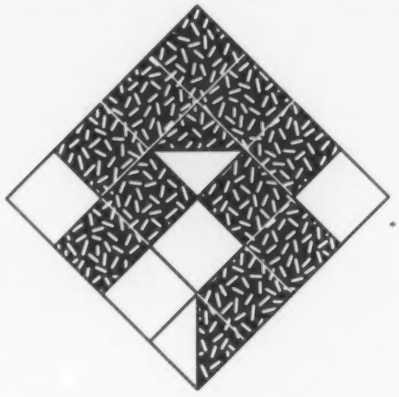
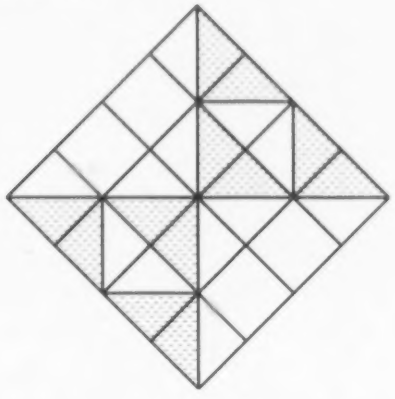
Multiple Weavings

Use red and white TexTiles. Build each design and record on grid paper.



Can you figure out how many TexTiles you'll need if you make eight 16-patches?



Can you figure out how many TexTiles you'll need if you make twelve 16-patches?

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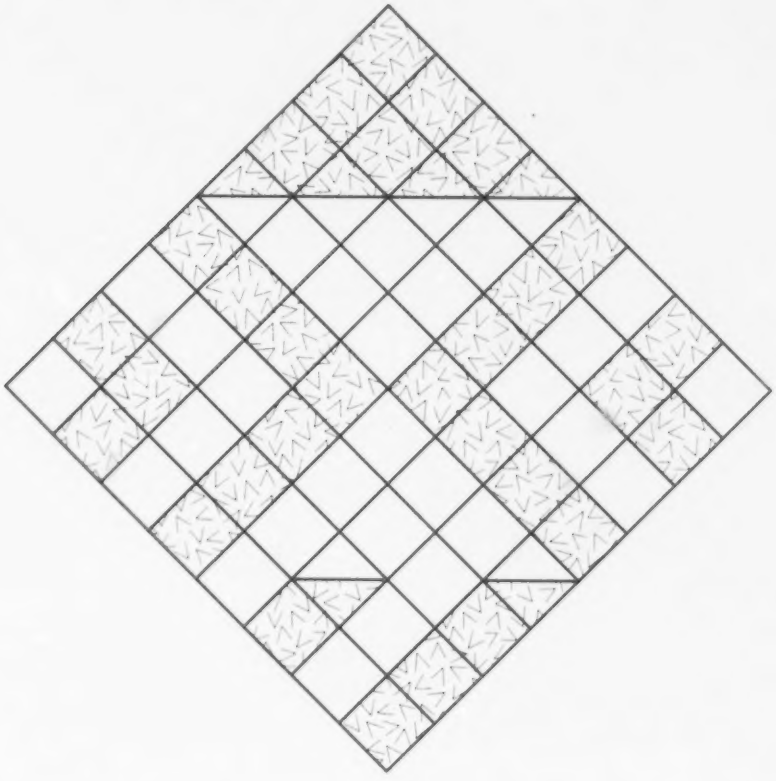
More Multiple Weavings

Use 2 colors of TexTiles.

Build this Maori design:



Record on grid paper. Can you figure out how many TexTiles you'll need if you make four 64-patches?

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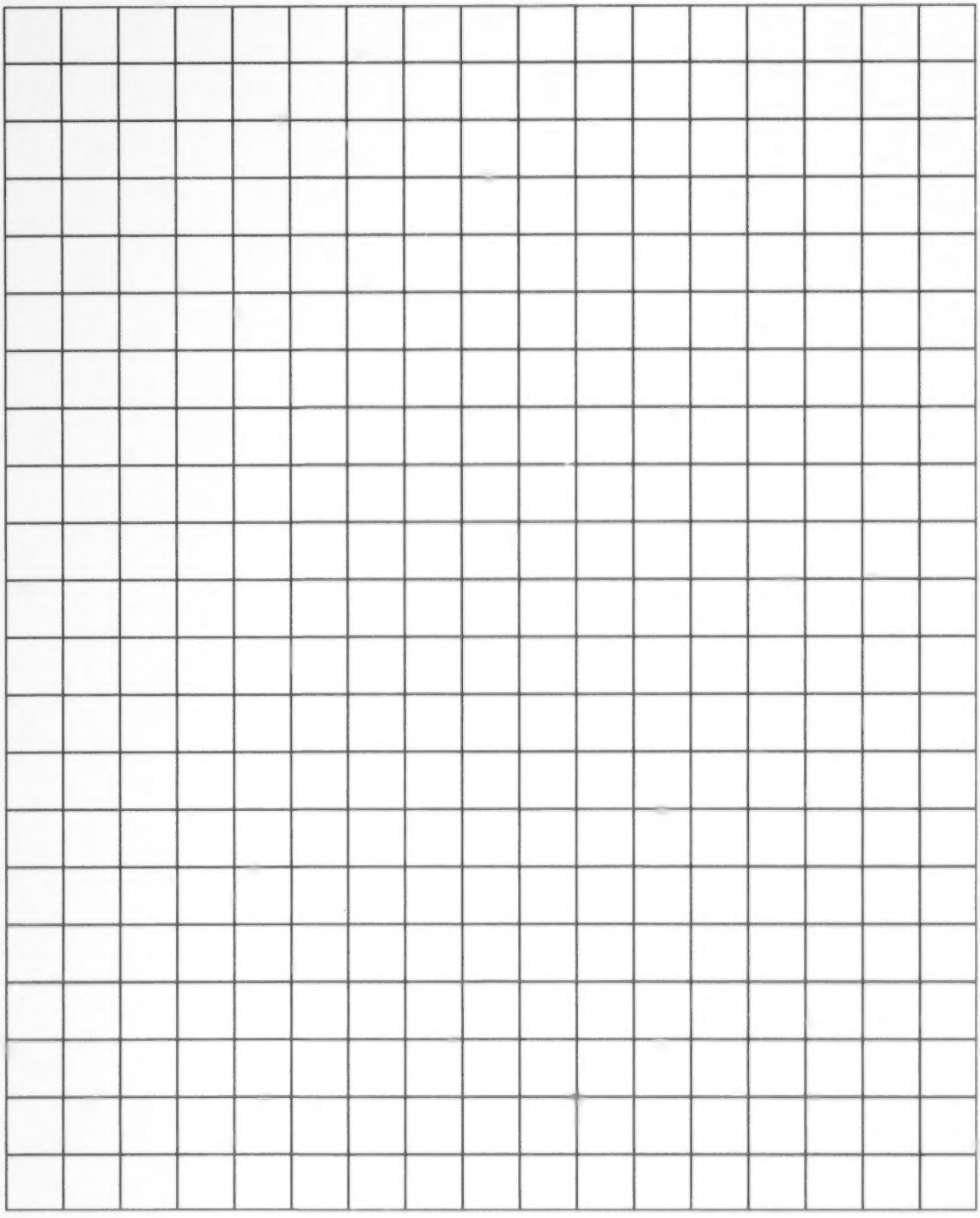
1 cm Grid Paper



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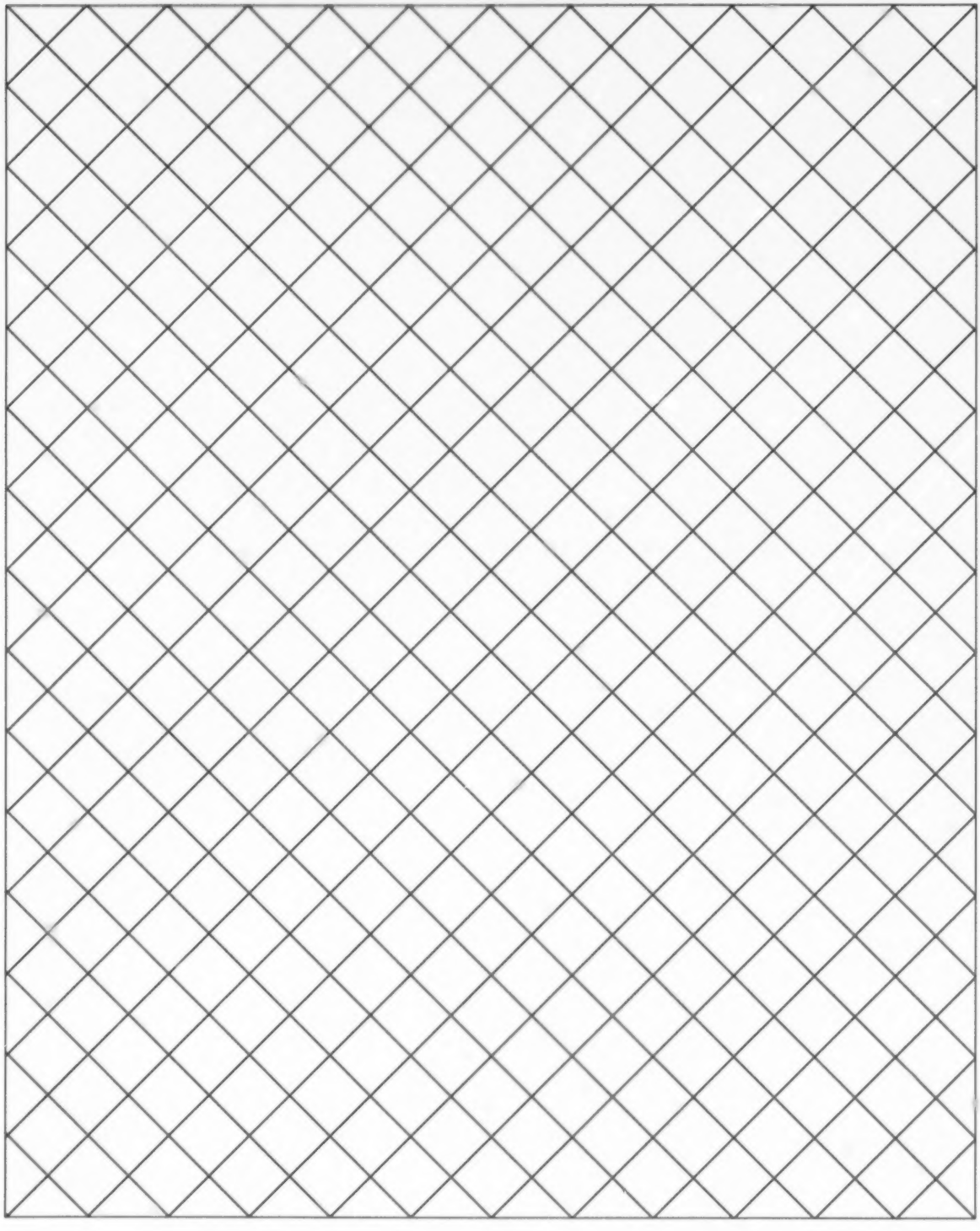

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Student's Bibliography

Ashabranner, Brent. *Children of the Maya.* New York: Dodd, Mead & Company, 1986.

Baquedano, Elizabeth. *Eyewitness Books, Aztec Inca & Maya.* New York: Alfred A. Knopf, 1993.

Beyer, Jinny. *Patchwork Patterns.* McLean, Virginia: EPM Publications, 1979.

Chan, Barbara. *Kid Pix Around the World.* Reading, MA: Addison-Wesley Publishing Company, 1993.

Coerr, Eleanor. *The Josefina Story Quilt.* New York: Harper and Row, 1986.

Ernst, Lisa Campbell. *Sam Johnson and the Blue Ribbon Quilt.* New York: Lothrop, Lee, and Shepard, 1983.

Flournoy, Valerie. *The Patchwork Quilt.* New York: Dial Press, 1985.

Geography Department. *Guatemala ... in Pictures.* Minneapolis: Lerner Publications, 1987.

Geraldine. *The Goat in the Rug.* New York: Parents' Magazine Press, 1976.

Guback, Georgia. *Luka's Quilt.* New York: Greenwillow, 1994.

Hopkinson, Deborah. *Sweet Clara and the Freedom Quilt.* New York: Alfred A. Knopf, 1993.

Johnson, Tony and Tomie De Paola. *The Quilt Story.* New York: Putnam, 1985.

Kinsey-Warnock, Natalie. *The Canada Geese Quilt.* New York: Cobblehill Books, 1989.

Livo, Norma J. and Cha, Dia. *Folk Stories of the Hmong.* Englewood, Colorado: Libraries Unlimited, 1991.

Miles, Miska. *Annie and the Old One.* Boston: Little, Brown and Company, 1971.

Musgrove, Margaret. *Ashanti to Zulu African Traditions.* New York: Dial Press, 1976.

O'Dell, Scott. *Sing Down the Moon.* Boston: Houghton Mifflin, 1970. (Navajo)

O'Dell, Scott. *The Captive.* Boston: Houghton Mifflin, 1979. (Maya)

Paul, Ann. *Eight Hands Round, A Patchwork Alphabet.* New York: HarperCollins, 1991.

Polacco, Patricia. *The Keeping Quilt.* New York: Simon and Schuster, 1988.

Reed, A.W. *Myths and Legends of Maoriland.* Auckland: A.H. & A.W. Reed, 1967.

Ringgold, Faith. *Tar Beach.* New York: Crown Publishers, 1994.

Roessel, Monty. *Kinaalda, A Navajo Girl Grows Up.* Minneapolis: Lerner Publications, 1993.

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Smucker, Barbara. *Amish Adventure.* Scottdale, Pennsylvania: Herald Press, 1983.

Sherrow, Victoria. *Huskings, Quiltings, and Barn Raisings.* New York: Walker and Company, 1992.

Steptoe, John. *Mufaro's Beautiful Daughters.* New York: Lothrop, Lee & Shepard, 1987.

Wisniewski, David. *Rain Player.* New York: Clarion Books, 1991.

Teacher's Bibliography

Berlant, Anthony and Kahlenberg, Mary Hunt. *Walk in Beauty, The Navajo and Their Blankets.* Boston: New York Graphic Society, 1977.

Frager, Dorothy. *The Book of Sampler Quilts.* Radnor, Pennsylvania: Chilton Book Company, 1983.

Havig, Bettina. *Amish Quiltmaker.* New York: Sterling Publishing Co., 1992.

Holstein, Jonathan. *The Pieced Quilt.* Greenwich, Connecticut: New York Graphics Society, 1973.

Jonas, Ann. *The Quilt.* New York: Greenwillow Books, 1985.

Lewis, Paul and Elaine. *Peoples of the Golden Triangle, Six Tribes in Thailand.* New York: Thames and Hudson, 1984.

Olsen, Kirstin. *Quilter's Pattern Workbook.* New York: Sterling Publishing Co., 1990.

Pellman, Rachel and Kenneth. *The World of Amish Quilts.* Intercourse, Pennsylvania: Good Books, 1984.

Roth, Susan, and Phang, Ruth. *Patchwork Tales.* New York: McClelland & Stewart, 1984.

Schevill, Margot Blum. *Maya Textiles of Guatemala.* Austin: University of Texas Press, 1993.

Smith, Joyce Ronald. *Taniko: Maori Hand-Weaving.* New York: Scribner's Sons, 1975.

von Gwinner, Schnuppe. *The History of the Patchwork Quilt.* West Chester: Schiffer Publishing, 1988.

Wahlman, Maude Southwell. *Signs and Symbols, African Images in African-American Quilts.* New York: Studio Books, 1993.

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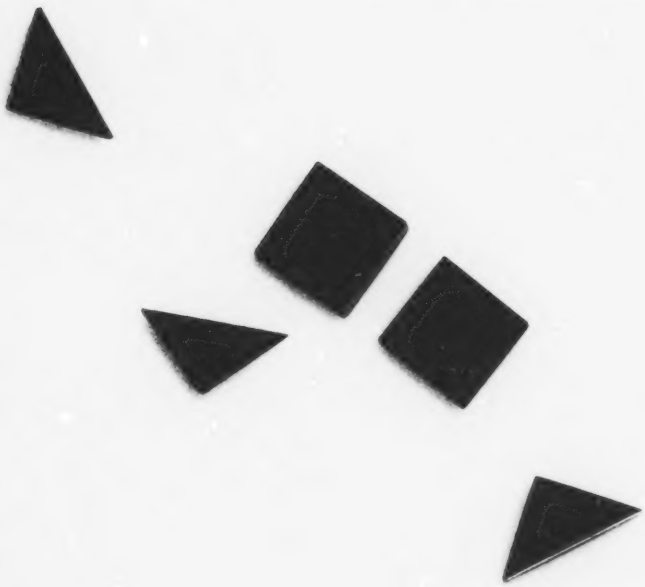

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